Taketo NAKANO* & Shinji HANDA**: *Botrydiopsis alpina* Vischer (Xanthophyceae) newly found in Japan***

中野武登*・半田信司**: 日本新産 *Botrydiopsis alpina* Vischer (黄緑藻綱)

Members of the genus *Botrydiopsis* (Mischococcales, Xanthophyceae) were found in freshwater, soil and on a lichen thallus. Five species of this genus have been described in the world (Pascher 1937-1939, Vischer 1945, Ettl 1978, Tschermak-Woess 1979), but only one species, *B. arhiza*, has been reported from Japan (Akiyama 1965, 1966, Nakano 1971, 1981). In the course of our floristic study of corticolous algae in Hiroshima Prefecture, we isolated an alga identified as *Botrydiopsis alpina* from a tree bark, and found that it was newly recorded as a corticolous alga and new to Japanese flora. This paper provides a description, illustrations and some taxonomical notes on this species.

Materials and methods Bark samples were collected from *Cephalotaxus harringtonia* (Knight) K. Koch in Taishaku-kyô limestone Gorge, northeastern part of Hiroshima Prefecture on December 13, 1987 (Handa-299). Sampling portions were about 1 m high above the ground on the northwest side of the trunk. On the surface of the bark collected, macroscopic algal colonies were not observed. In the laboratory, attached materials including algae were gently scraped from the surface of the bark. Isolation and purification of algae were accomplished in the manner described by Wiedeman et al. (1964) and Handa and Nakano (1988). Culture vessels were placed under standard conditions (temperature 22±1°C, illumination about 3000 lux light intensity on a diurnal light cycle of 12 hr light and 12 hr darkness). Axenic or unialgal cultures incubated on 1 N BBM agar slants under the above-mentioned conditions were observed with the light microscope at ×1000 magnification. Cultured specimens are deposited in the Culture Collection of Hiroshima University (CCHU).

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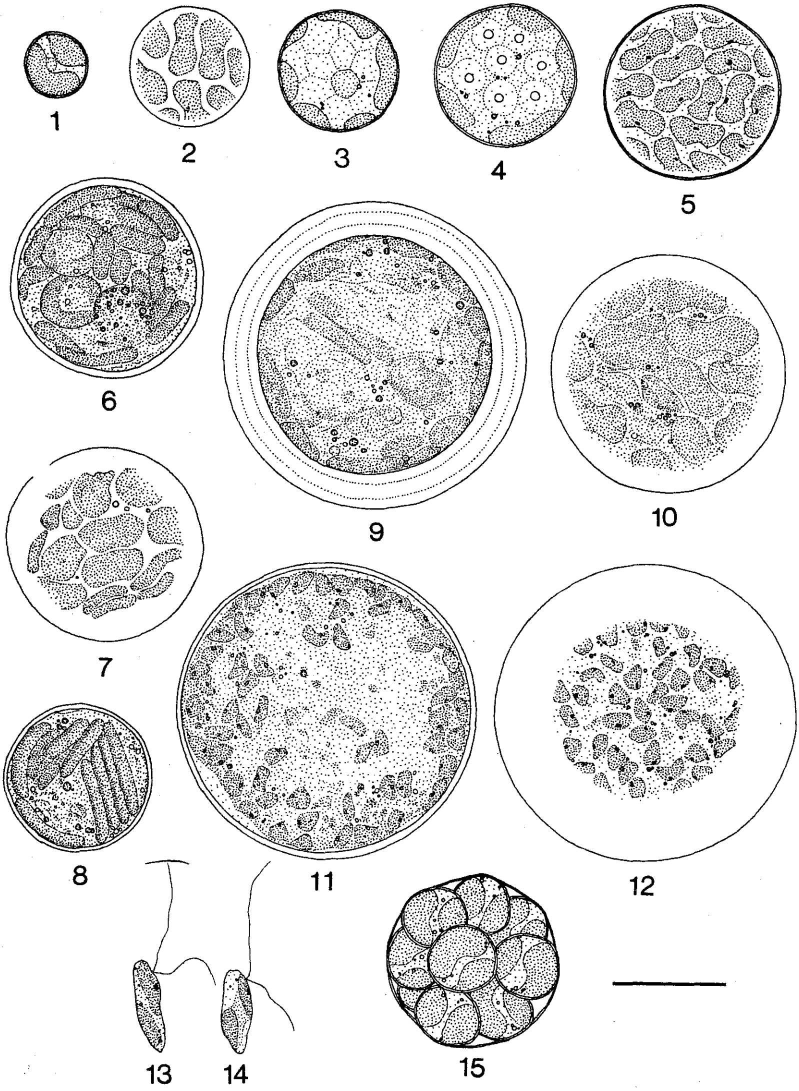

Botrydiopsis alpina Vischer in Erg. Wiss. Unters. Schweiz. Nationalparkes 1: 487, figs. 5, 6, 1945. Reisigl, Österr. Bot. Z. 111: 424, 1964. Ettl, Süsswasserflora von Mitteleuropa, 3/1: 251, 1978. Tschermak-Woess, Pl. Syst. Evol. 131: 179, figs. 1-5, 1979. (Figs. 1-21)

Cells solitary, spherical, 18-20 μm, sometimes up to 50 μm in diameter. Cell wall smooth, thin but sometimes thickened in stationary phase of cultures. Chloroplast one to many, parietal, oval or disk-shaped in younger cells, but in log phase of cultures, almost oval, constricted at the middle portion, with a stigma at the portion of constriction. In the stationary phase of cultures, flattened, stacks of chloroplasts formed. Multinucleate in adult cells. Oil droplets present.

Reproduction by forming zoospores or aplanospores. Zoospore of Protosiphon-type, various in shape, with two unequal flagella, with one or two chloroplasts. Only one chloroplast with a stigma. Contractile vacuoles and nucleus indistinct.

Specimen examined: Japan, Honshu, Hiroshima-ken, Jinseki-chô, Taishakukyô Gorge, from the trunk of *Cephalotaxus harringtonia* (Knight) K. Koch, December 13, 1987 (Handa-299).

Habitat: growing in soil, on lichen thallus and tree bark.

Geographical distribution: Austria, Switzerland and Japan.

This species is newly found as a corticolous alga and newly reported from Japan.

Our alga agrees well with the descriptions by Vischer (1945), Reisigl (1964) and Tschermak-Woess (1979) with a few exceptions.

The vegetative cells of *Botrydiopsis alpina* observed were spherical throughout the culture age. Mature cells were 18-20 μm in diameter (Figs. 5, 17). In the stationary phase of culture, however, giant vegetative cells (up to 50 μm in diameter) were sometimes observed (Figs. 9, 10). Tschermak-Woess (1979) also observed such large vegetative cells in stationary cultures. The

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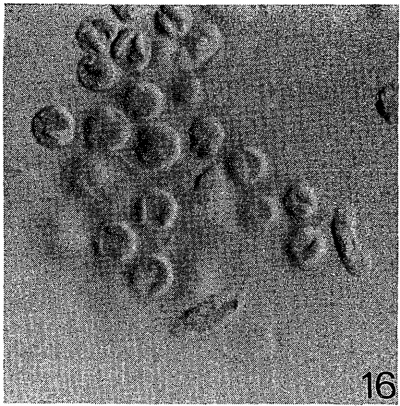
Figs. 1-15. *Botrydiopsis alpina* Vischer. 1. Young vegetative cell after settling of zoospore. 2. Surface view of a young vegetative cell. Note initials of stigmata in chloroplasts. 3. Median optical section of the same cell. 4. Mature vegetative cell with several nuclei. 5. Mature vegetative cell. Note stigmata in chloroplasts. 6. Median optical section of vegetative cell with stacked chloroplasts in stationary phase of cultures. 7. Surface view of the same cell. 8. Vegetative cell with stacked chloroplasts in stationary phase of cultures. 9. Median optical section of a giant cell with thickened cell wall. 10. Surface view of the same cell. 11. Median optical section of a zoosporangium. 12. Surface view of the same cell. 13. Zoospore with two chloroplasts. Note a stigma in only one chloroplast. 14. Zoospore with one chloroplast. 15. Aplanosporangium. Scale bar: 10 μm.



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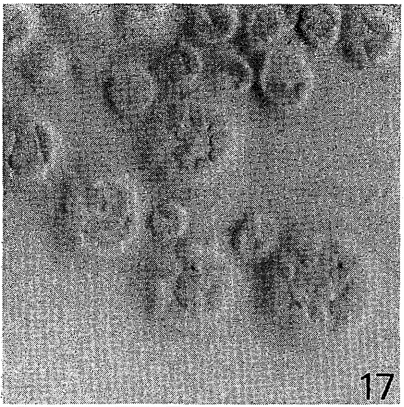

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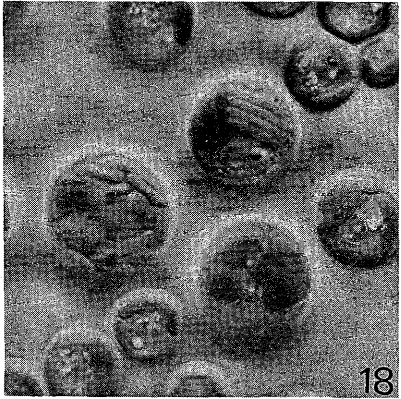

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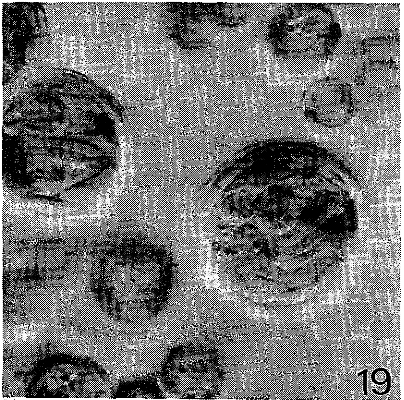

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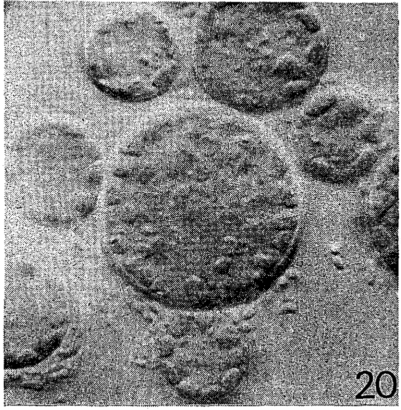

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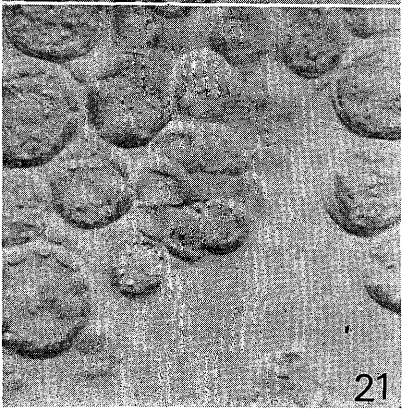

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giant cells observed by her had thickened cell walls often composed of concentric layers and many flattened and stacked chloroplasts. Our giant cells had thickened cell walls, about 3.0 μm in thickness and consist of several layers (Fig. 9). In these cells, oval or discoidal chloroplasts were observed at the margin of the cell lumen and stacked chloroplasts in the center. Furthermore, many oil droplets were observed. Judging from their cell morphology, these giant vegetative cells observed in stationary cultures seem to be in a resting state.

This alga had one to many chloroplasts according to cell size. In very young vegetative cells, chloroplasts were oval or discoid (Fig. 1). However, in early growth and mature stages, they regularly were almost oval with a constriction at the middle portion (Figs. 2, 5, 17) and each chloroplast had a distinct stigma at the constricted portion (Figs. 2, 5, 17). When chloroplasts were dividing into two segments, the stigmata were reproduced together with the chloroplasts. The reproductive process of the chloroplast and stigma of this alga was reported in detail by Tschermak-Woess (1979).

Concordant with the observation of Tschermak-Woess (1979), our material in the stationary phase of cultures shows an arrangement of chloroplasts in stacks (Figs. 6, 8, 18, 19). These stacks were either solitary or parallel with one another. They occupied the margin or in the center of the cell lumen. In these stacks of chloroplasts, a stigma could not be observed. This is an unusual fact not observed in other algae.

Reproduction occurred by the formation of zoospores and aplanospores. Zoosporangia were larger than mature vegetative cells (Figs. 11, 12). At zoosporogenesis, many oval chloroplasts were produced and each chloroplast had one stigma (Figs. 11, 12). Zoospores varied in shape, being ellipsoidal, fusiform, ovoid, etc. They had one chloroplast and two unequal flagella arising at the subapical portion (Figs. 13, 14, 16). There exist differing reports concerning the number of chloroplasts in zoospore of this alga. Vischer (1945) reported one to two chloroplasts, Reisigl (1964) two or three and Tschermak-Woess (1979) two. In our material, the zoospore had one or two parietal chloroplasts and every chloroplast contained one stigma. On the other hand,

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Figs. 16-21. *Botrydiopsis alpina* Vischer. 16. Zoospores and young vegetative cells. 17. Mature vegetative cells. 18, 19. Vegetative cells with stacked chloroplasts in stationary phase of cultures. 20. Zoosporangium. 21. Aplanosporangium. ×1150.

Tschermak-Woess (1979) reported that zoospores had only one stigma even when two chloroplasts were present per cell.

Ettl (1978) considered *Botrydiopsis alpina* as an ecotype of *Botrydiopsis intercedens*. However, Tschermak-Woess (1979) recognized *B. alpina* as a distinct species based on her own observations (1979). We agree with the opinion of Tschermak-Woess (1979).

The present report shows that *Botrydiopsis alpina* occurs in places as far apart as Middle Europe and Japan. It occupies different microhabitats, viz. soil and bark (Vischer 1945, Reisigl 1964, present report). In one case it probably came from soil surrounding a moss inhabiting the lichen thallus (*Lobaria linita*) on which it lived epiphytically (Tschermak-Woess 1979).

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広島県北東部の帝釈峡に生育するイヌガヤの樹皮上から黄緑藻類の *Botrydiopsis alpina* Vischer を分離した。本藻は球形で，直径 18-20 μm である。葉緑体は側壁性で，ごく若い細胞中では長円形または円盤状であるが，増殖期にある細胞中ではほとんどが長円形で中央部に狭窄を持つ。狭窄部には1個の眼点を持つ。古い細胞では，扁平な葉緑体の蓄積がみられる。この現象は他の藻類では知られていないものである。増殖は遊走子と不動胞子による。日本新産。

□福代康夫・高野秀明・千原光雄・松岡数充（編）: **日本の赤潮生物—写真と解説** 407 pp. 1990. 内田老鶴圃，東京. ¥13,390. 日本の近海及び日本の淡水域に出現して赤潮をつくる生物と赤潮をつくる可能性があると思われる生物200種を収録している。内訳は，藍藻8種，クリプト藻2種，渦鞭毛藻70種，珪藻85種，ラフィド藻9種，黄金色藻6種，ハプト藻4種，ユーグレナ藻8種，プラシノ藻5種，緑藻1種，原生動物2種である。1種につきB5判の見開き2頁をあて，光顕及び電子顕微鏡写真と図に続いて，図の説明，和文記載，英文記載，文献が記され，記載には細胞の形態・構造，生殖法，生活史，生態と分布，類似種との比較等の記述が盛られている。過去6年間に亘る水産庁からの委託研究の成果の一部であり，先に出版された高野秀明・千原光雄・福代康夫編「赤潮生物研究指針」740 pp. 1987年（日本水産資源保護協会，20,000円）とともに，赤潮研究者あるいは赤潮生物について知見を得たい人々にとり座右の書となるであろう。なお，題は赤潮生物となっているが，潜在的な赤潮生物も扱っているので，日本近海のプランクトン図鑑の役割も果たしてくれる。 （出井雅彦）

□野生生物保護問題研究会（編）: **稀少野生動植物の国内取引規制法 その内容と手続き** 127 pp. 1988. ぎょうせい，東京. ¥800. いわゆるワシントン条約による取引規制生物のリスト，関係法規，手続きおよびその解説より成る。 （金井弘夫）

□木村陽二郎（編）: **白井光太郎著作集 第VI巻 本草百家伝・その他** 355+63 pp. 1990. 科学書院，東京. ¥15,450. 本草百家伝の復刻および木村氏による校訂，資料をつけ加えたもの。日本の博物学史研究に有用な一書である。 （金井弘夫）